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PAPERS

IN

MECHANICKS.

MECHANICKS.

The Thanks of the Society were given to Mr. JOHN ADAMS, of the Academy at Edmonton, for the following communication, reſpecting the ſubdiviſion of a Nonius invented by him.

PERMIT me, Gentlemen, to lay before you a ſubdiviſion of a Nonius, by means of which, the diviſions of a quadrant, &c. twenty inches radius, may be read off to a ſecond, or leſs; and the inſtrument rendered equal, if not ſuperior, in many caſes, to the mural Quadrant at Greenwich.

To elucidate this, let us ſuppoſe the limb of a quadrant divided in the common manner,

ner, each degree into parts of twenty minutes each; then the ſpan or arch of nineteen of theſe diviſions being laid upon the index, and divided into twenty equal parts, makes the Nonius; which will read off to a minute: the principle of which is too well known to need more to be ſaid on that head: and the ſubdiviſion is equally eaſy to be underſtood, being upon the ſame principle. Therefore let the ſpan taken upon the index be one minute greater or leſs than the nineteen diviſions; then it will be evident, that in the former caſe (when it is one minute more), there will be as many times three ſeconds to be ſubtracted as the coincident diviſion of the Nonius points out minutes to be added; and in the latter caſe, as many times three ſeconds are to be added.

Now, as an inſtrument, five inches radius, can be divided into half-minutes accurately, and be read off to quarter-minutes, or leſs. One of twenty inches radius will give four times the ſcope; and may be divided ſo finely, that a coincidence muſt very often take place amongſt the lines on the limb, and Nonius on the index: if not, the difference may be eſtimated to a very great nicety. Again, ſuppoſing each degree on the limb, or arch, to be divided into parts, of ten minutes each; then nineteen of thoſe parts, more or leſs, twenty ſeconds being laid upon the Nonius, and divided into twenty parts, will again biſect, and make forty parts.

Such an inſtrument will, on a perfect coincidence, be read off to half a ſecond.

It often happens in inſtruments, that the Nonius, either over or under ſpans a ſmall quantity; which, if diſcovered, and divided by the number of diviſions on the Nonius, gives the quantity to be added or ſubtracted for each diviſion, and proves a perfection in a well-divided inſtrument. This accident gave riſe to the idea, which has been fully verified by

Your humble ſervant,

JOHN ADAMS.

To the Society for the Encouragement of Arts, Manufactures, and Commerce.

THE accidents that frequently happen, in uſing the Jack for raiſing large weights, from the want of a contrivance to prevent the machine running back if the weight by any means overcomes the power, has long been obſerved; but no attempts ſeem to have been made to protect the workmen on that occaſion. Mr. Mocock, of Southwark, having produced a Jack, with a Click and Ratchet, ſo contrived as to prevent that danger, the Society voted to him a bounty of Twenty Guineas, he leaving a model with the Society for the uſe of the public.

On examining the annexed plate of Mr. Mocock's Jack, it will appear not to differ much, either in principle or conſtruction, from thoſe in common uſe; except that in this Jack a Pall, or Click and Ratchet, are applied in ſuch manner as to hold the machine faſt, if the weight overcomes the power, and thereby prevent any accident the workmen may be ſubject to, by the running down of the machine; by which the men are frequently expoſed to danger, and often ſuffer, eſpecially on board ſhips in engagements; when, from inattention or neglect in fixing the hooks, or from any other cauſe, the Jacks hitherto in uſe fail in the working.

Explanation of the Plate of Mr. Mocock's *improved* JACK FOR RAISING LARGE WEIGHTS.

A, A. The double handles of the winch.

B. The large-toothed wheel, in which the pinion on the axis (C) works.

D. A ratchet-wheel.

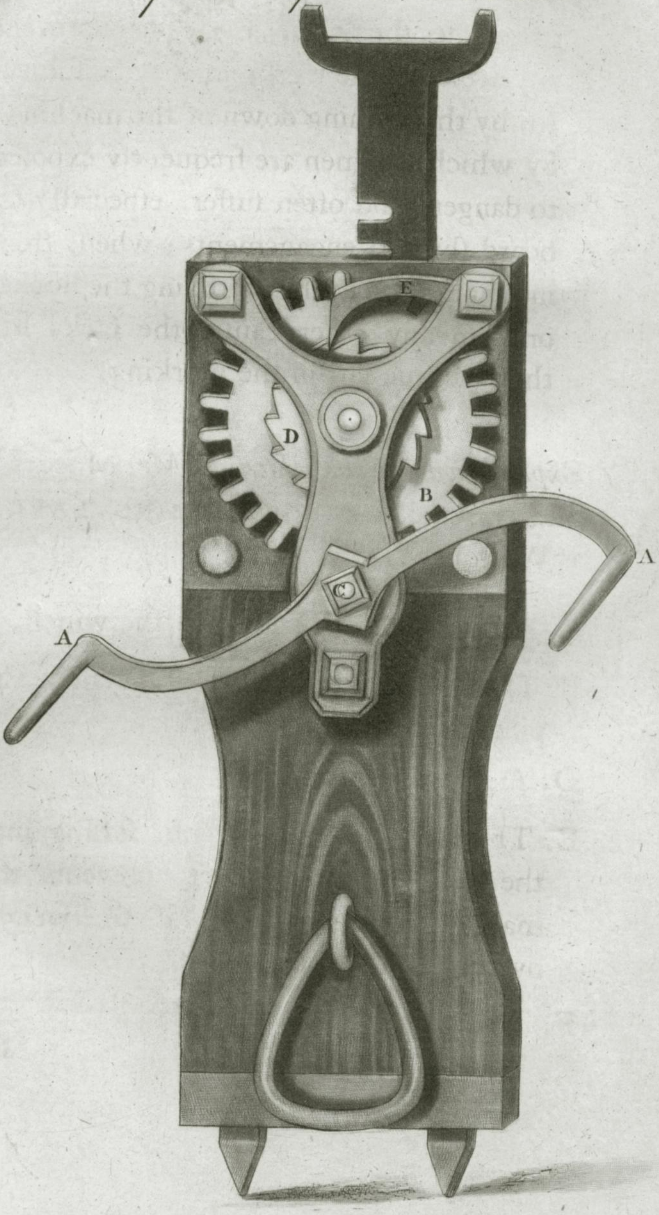
E. The click or pall, which, falling into the teeth of the ratchet, prevents the machine running back, if the weight overcomes the power.

F. The rack, as in common jacks.

IT

Plate II.

A Jack for raising large weights, improved by Mr. Mocock.



IT is with particular ſatisfaction the Society obſerve the progreſs making in the uſe of the Gun-Harpoon, in the Whale Fiſhery; which, as it was firſt encouraged by them, has ever continued an object of their attention, and now promiſes to become annually of more general uſe. The following Certificates will further evince the utility of that contrivance; and as the Fiſh taken were ſhot at a diſtance at which it would have been utterly impoſſible to have ſecured them by the Hand-Harpoon, every one ſo taken may be conſidered as clear gain to the Nation.

The following Certificates having been received, the ſeveral Premiums, offered for Whales taken by means of the Gun-Harpoons, being THREE GUINEAS for each whale, were adjudged to the Harpooners under mentioned.

THIS is to certify, That JOHN DRYDEN, of the ſhip Arnold Polly, ſhot a large fiſh, the 29th of May, this preſent year, at the diſtance of about twelve or fourteen fathoms.

(Signed) JAMES FRAZER,
Maſter.

Oct. 9th, 1789.

THIS is to certify, That THOMAS WILKINSON, Harpooner on board the ſhip Butterworth, ſhot a fiſh with the Gun-Harpoon, in Davis's Streights.

JOHN STEEL, Harpooner, on board the ſaid ſhip, ſhot a fiſh on the ſame voyage.

MARSHALL SUMMERS, on board the ſaid ſhip, ſhot a fiſh during the ſame voyage.

And JOHN WHELDON, Harpooner on board the ſaid ſhip, ſhot two fiſh on the ſame voyage.

GENTLEMEN,

I TAKE the liberty to inform you, that I ſigned the foregoing Certificates for four Harpooners, who ſhot five fiſh laſt year in Davis's Streights, between the latitudes 70 and 72 north, on Baffin's London coaſt.

1789.—May 31ſt, THOMAS WILKINSON ſhot a fiſh at about nine fathoms diſtance.

June 3d, JOHN STEEL ſhot a fiſh at about ten fathoms diſtance.

June 9th, MARSHALL SUMMERS ſhot a fiſh at about ſix fathoms diſtance.

May 22d, JOHN WHELDON ſhot a fiſh at about eight fathoms diſtance. And

July 7th, JOHN WHELDON ſhot alſo another fiſh at about fourteen fathoms diſtance.

The above fiſh were all killed in a very ſhort time, in conſequence of the Gun-Harpoon going ſo far into the bodies of them.

I am, Gentlemen,
Your moſt obedient, humble ſervant,
WILLIAM BROWN,
Commander of the ſhip Butterworth.

To the Society for the Encouragement of Arts, &c.

SIR,

I HAVE taken the liberty to requeſt, that you will lay the following Certificates before the Society of which you are the Secretary; which will ſerve a very deſerving man, in whoſe favour it is written, as well as oblige,

SIR,
Your very humble ſervant,
JOHN WHEATLEY.

Stepney Cauſeway,
Nov. 29, 1789.

Mr. MORE.

THIS is to certify, That GEORGE LESHLEY, a Harpooner, of the Britannia of London, under my command, did, in Davis's Streights, this laſt ſeaſon, ſhoot two whales with the Gun-Harpoon; which I hope will entitle him to the premium offered by the Society; and is the cauſe of my laying this account before them; the firſt on the 28th of May, 1789, in latitude about 71° north, at ten fathom diſtance. He fired, and ſhot about ſix feet into the body of the fiſh: it ran out two lines, and came up in about twenty minutes, blowing blood, and very much ſpent, and was killed by the other boats in a few minutes: when it was got along-ſide, we were obliged to heave a tackle to get the harpoon out again. Length of bone, ten feet nine inches.

The ſecond was ſhot in latitude 71°, 34′, by obſervation, on the 19th of June, 1789. He ſhot it, at twelve fathoms diſtance, in the rump: he had followed it near an hour, it being calm; and when he got within thirty or fifty fathom, the fiſh, diſturbed by the noiſe of the oars, frequently went under water; but he followed it by its wake, till he ſhot it as above mentioned.

It ran out ſeven lines, and was killed in about two hours. Length of bone, ten feet one inch.

I am, Gentlemen,

Your moſt obedient, humble ſervant,

JOHN WHEATLEY.

To the Society for the Encouragement of Arts.

The Thanks of the Society were preſented to Lieutenant-Colonel DANSEY for the following Letter, accompanied with a Drawing and Model of a Machine for draining Ponds without diſturbing the mud; of which a Plate and Deſcription are here given, and the Model and Drawing remain in the Repoſitory of the Society for the inſpection and uſe of the Public.

SIR,

I FEEL myſelf much indebted to Owen Saluſbury Brereton, Eſq. V. P. of the Society for Encouragement of Arts, Manufactures, and Commerce, for the trouble he has had in producing to the Society the model of a Machine for draining Ponds without diſturbing the mud; which model I made from a deſcription given me about a twelve-a twelvemonth ago by Coppleſtone Warre Bamfield, Eſq. of Heſtercombe near this place, of a machine he has had in uſe theſe fifteen years for ſupplying a caſcade in his pleaſure-grounds. Our regiment being quartered at Windſor, I thought the invention might be uſeful to ſupply the grand caſcade at Virginia Water; which induced me to make the model, and ſhew it to his Majeſty. It met his gracious approbation; and by his command Mr. Robinſon ordered a penſtock on that principle at one of the ponds in the neighbourhood; which wss conſtructed from that model, under the direction of Mr. Sandby.

Flattered by its having been ſo far approved, I ſhewed it to Mr. Saluſbury Brereton, and, on leaving Windſor, deſired his patronage of it; and promiſed, when I met Mr. Bamfield, we would fully explain its uſe and conſtruction. The thought ſtruck me, that it might be very uſeful in the hands of men of ſcience, and applicable to ſilk, cotton, and other mills, where a ſteady and uniform velocity of water is wanted; which may be regulated at pleaſure; and occaſioning no current to diſturb the mud or fiſh, the ſtream being conſtantly running from the ſurface.

I have frequently made the experiment by the model in a tub of water; which it is calculated to do. My wiſhes will be fully gratified, if, by my means, the invention becomes of public utility.

I am, SIR,

Your very humble ſervant,

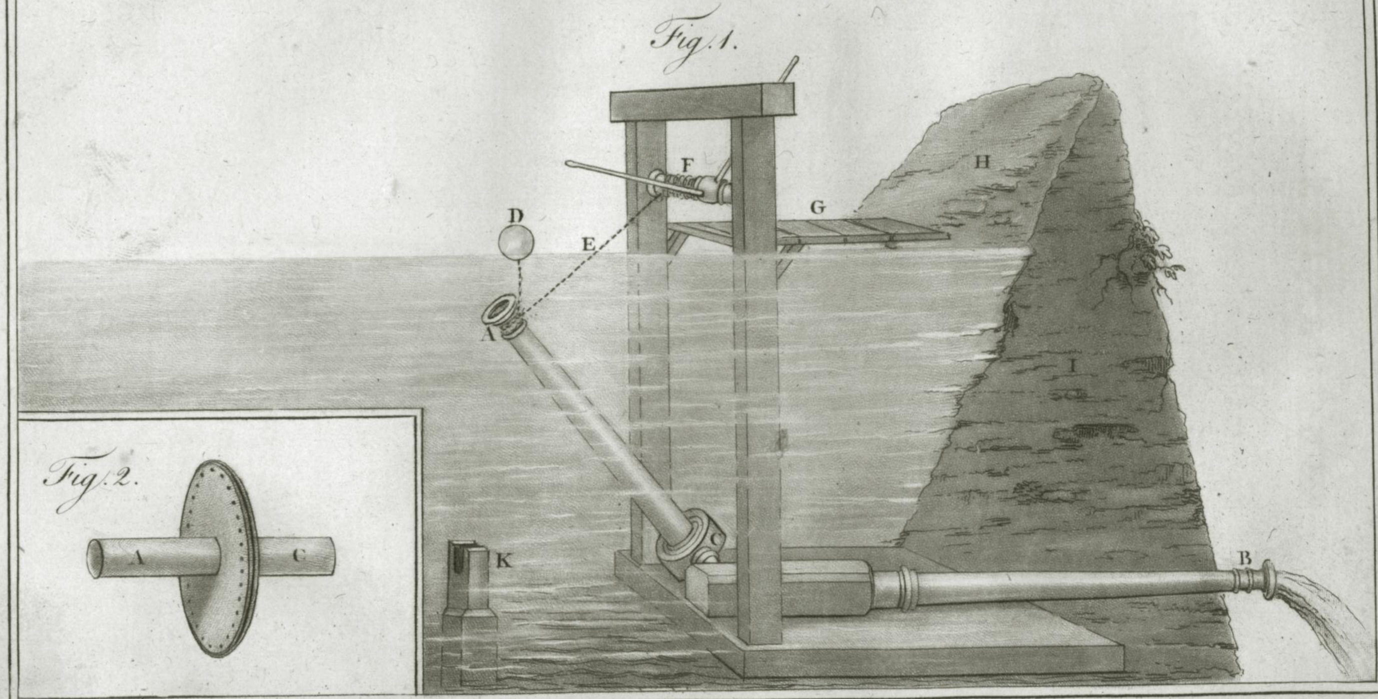
WILLIAM DANSEY.

Taunton,
Dec. 30*th*, 1788.

Mr. MORE.

Plate III.

Machine for draining Ponds without disturbing the Mud.



DESCRIPTION *of the Plate of the* MACHINE FOR DRAINING PONDS, *&c. without diſturbing the Mud.*

FIGURE I.

A. The pipe, loaded with a rim of lead, of ſuch weight as ſerves to ſink it below the ſurface of the water.

B. The diſcharging pipe, laid through the bank, H, I.

C. The joint, on which the pipe, A, turns its form, ſhewn Fig. 2.

D. The ball or float; which, ſwimming on the ſurface of the pond, prevents the pipe, A, deſcending deeper than the length of the chain by which they are connected.

E. A chain winding on the windlaſs, F; and ſerving to raiſe the tube, A, above the ſurface of the water, when the machinery is not in uſe.

G.

G. A ſtage.

H, I. The bank, repreſented as if cut through at I, to ſhew the tube, B, lying within it.

K. A poſt to receive the tube, A, when lowered, and prevent its ſinking in the mud.

FIGURE II.

A. A caſt cylinder, with a plate or cheek, B, which is faſtened to the timber of the tube on one ſide, but not on the other, as the part of the cylinder, C, turns in the hollow of the wooden tube, when it is immerged. A piece of ſtrong ſole leather is put inſide the braſs plate, B, to prevent leaking.

IN the year 1781 a SILVER MEDAL was voted by the Society to Mr. MATTHEW QUIN for his improvements of the Hydrometer. (See Vol. II. of theſe Tranſactions.) And this year Mr. Quin having produced an inſtrument ſtill more perfect, (ſee the annexed Plate), the Society voted him, as a further bounty, a SILVER MEDAL and TWENTY GUINEAS. It is now believed that little more is wanting to the perfecting the Hydrometer, as a uſeful and practical inſtrument for diſtillers, brewers, and chemiſts; Mr. Quin having ſo ſimplified it, that with *four* weights only, the ſtrength of ſpirits, and alſo of worts, may be readily and commodiouſly aſcertained by it, to as great a degree of preciſion as is required in buſineſs. Various have been the attempts to render the Hydrometer perfect; as it is known that an inſtrument which would with eaſe determine the comparative ſtrength of ſpirits, would prevent thoſe continual diſputes that ariſe between the officers of government and dealers in ſpirits. Many ingenious contrivances have been brought forward for that purpoſe; but the inventors of them have thrown the buſineſs into great confuſion, by the neceſſity they have imagined there was for increaſing the number of weights to a very great degree; and even adapting ſeparate weights and inſtruments to determine the ſtrength of ſpirits, or the gravity of worts. The leſſening the number of ſuch weights will appear a matter of great importance to thoſe who are acquainted with the manner in which ſuch large works as breweries and diſtilleries are neceſſarily carried on; and as it appeared by various trials, made with as much care as poſſible, that the Hydrometer produced by Mr. Quin was full as accurate as any tried at the ſame time, both in ſpirit and wort, Mr. Quin's inſtrument anſwering both purpoſes.

It is now hoped the inſtrument is brought to ſuch ſimplicity in its conſtruction, and ſuch facility in its uſe, as may fully anſwer the intention both of the officers of government, and the public at large.

To the Society for the Encouragement of Arts, Manufactures, and Commerce,

The humble Memorial of MATTHEW QUIN, *Balls-pond, near Newington-green,*

SHEWETH,

THAT in conſequence of the many complaints, which were made ſome years ago by the diſtillers, and dealers in ſpirits, of the great inaccuracy and numerous defects of Clarke's Hydrometer, your Memorialiſt was induced to make Hydrometers on an improved plan; for which he was honoured with the Silver Medal of the Society in the year 1781.

That the imperfections complained of were clearly proved in the Court of Exchequer; and Government found it expedient to have accurate inſtruments; but introduced a clauſe laſt ſeſſion (in the expiring law-bill) to legalize Clarke's Hydrometers for twelve months, in order that proper experiments might be made.

That your Memorialiſt begs leave to ſtate, that he has completed a new and univerſal Hydrometer; whereby the real ſtrength of any ſpirit, from alcohol to water, may be aſcertained in the moſt plain and expeditious manner; and points out the concentration of each ſtrength; alſo diſcovers the gravity of worts; and eſtimates the comparative value of malt, &c. with four weights only.

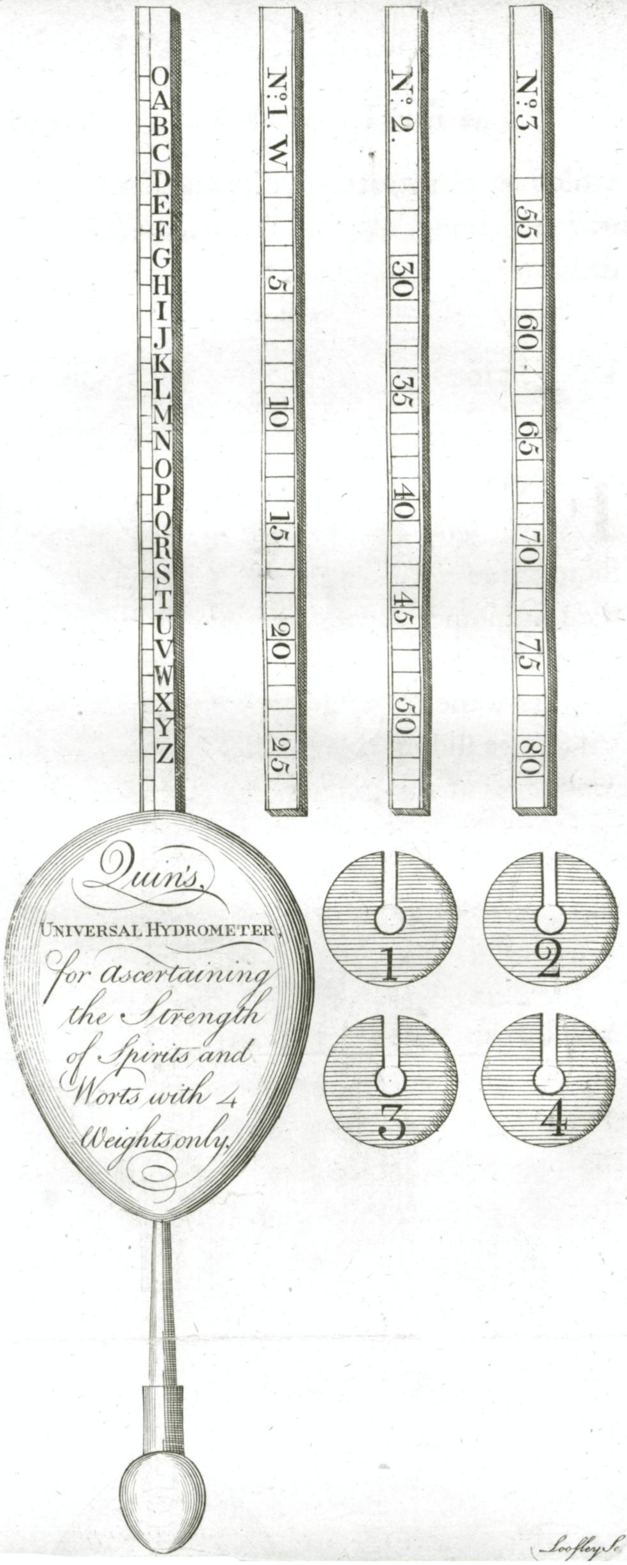
That your Memorialiſt, having heard that the Royal Society have been trying experiments, humbly prays, that the Society for Encouragement of Arts, Manufactures, and Commerce, will be pleaſed to examine the merits of his new inſtrument, and of the various Hydrometers now in uſe; truſting, that when their properties have been duly conſidered, the opinion of the Society will have proper weight with Government, in eſtabliſhing that Hydrometer which may be found moſt worthy of their approbation.

Your Memorialiſt, as in duty bound,
will ever pray.

Nov. 4th, 1789.

DESCRIPTION *of* MATTHEW QUIN's *improved* HYDROMETER *for* SPIRITS *and* WORTS.

THIS Hydrometer is made in hard metal; and is therefore not ſo liable to be bruiſed or out of repair as fine copper, of which Hydrometers are uſually made; and is ſo conſtructed as to aſcertain, in the moſt plain and expeditious manner, the ſtrength of any ſpirit, from alcohol to water; with the concentration and ſpecific gravity of each different ſtrength: and diſcovers alſo the weight of worts, &c. with four weights only; which, according to the old conſtruction of Hydrometers, would require a far greater number of weights. The ſide of the ſquare ſtem of the inſtrument, engraved, A, B, C, &c. to Z, ſhews the ſtrength of any ſpirit, from alcohol to water; and the three other ſides, numbered, 1, 2, 3, are adapted for worts, &c. As the denſity of fluids alters with heat and cold, every different ſtrength has a peculiar degree of contraction and dilatation which


O A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
N.º 1. W
N.º 2.
N.º 3.
Quin's
UNIVERSAL HYDROMETER,
for ascertaining the Strength of Spirits and Worts with 4 Weights only.

Looſley Sc.

which is conſidered in dividing the ſliding rule belonging to, and ſold with, the Hydrometer.

DIRECTIONS *for the uſe of* MATTHEW QUIN'*s* HYDROMETER.

FIND the heat of the ſpirit by the thermometer; and bring the ſtar on the ſliding rule to the degree of heat marked on the thermometer ſcale, and againſt the number of the weight, and letter on the ſtem. You have the ſtrength of the ſpirit pointed out on the ſliding rule; which is lettered and numbered at the inſtruments and weights.

Example. — Suppoſe the heat of the ſpirit 65° by the thermometer; and of ſuch ſtrength as to ſink the Hydrometer to D, on the ſtem, without any weight; then put the ſtar to 65° of the thermometer, and againſt D; you have ſeventy-five gallons to the hundred over-proof: at this ſtrength the concentration is five gallons (marked above 75); and the ſpecific gravity is nearly

eight

eight hundred and eleven, as marked below D: ſo that, if ſeventy-five gallons of water are added to one hundred gallons of this ſpirit, the mixture will be hydrometer-proof; but will only produce in meaſure one hundred and ſeventy gallons. Again, let the heat be 50°, and the ſpirit to require the weight N° 1 to ſink the inſtrument to I, on the ſtem; then put the ſtar to 50° of heat, and againſt I, on the ſliding rule you have $52\frac{1}{8}$ gallons to the hundred over-proof, concentration $2\frac{1}{4}$ gallons, and the ſpecific gravity eight hundred and fifty-four.

If the inſtrument, with the weight N° 2, ſhould ſink to Q, on the ſtem, and the heat 41°, it ſhews the ſtrength 19 gallons, to the hundred over-proof, concentration $\frac{3}{4}$, ſpecific gravity 905.

If the ſpirit be at 32° of heat, and the weight N° 3 ſinks the inſtrument to letter S, on the ſtem, it ſhews the liquor to be thirteen gallons in the hundred under proof, concentration $\frac{1}{4}$, ſpecific gravity 945.

30° of heat, and the inſtrument ſinking to M, with weight N° 4, ſhews fifty-ſeven gallons in the hundred under-proof, concentration nearly ½ a gallon, ſpecific gravity 976¾. So of the reſt.

In aſcertaining the ſtrength or gravity of worts, the weight N° 4 is always to continue on the Hydrometer; and the weights N° 1, 2, 3, are adapted to the ſides, N° 1, 2, 3, of the ſquare ſtem; which diſcovers the exact gravity of the worts.

The inſtrument is adjuſted ſo as to ſink in rain water, at 60° of the thermometer, with the weight N° 1, to W, on the ſide of the ſtem N° 1, and ſhews to 26° heavier than water.

The ſide N° 2, with its correſponding weight N° 2, ſhews from 26 to 53 degrees; and the ſide N° 3 aſcertains from 53 to 81 degrees, or 40½ pounds per barrel heavier than water; two degrees on the ſtem being a pound per barrel.

Uſe

Uſe of the Hydrometer in aſcertaining the Gravity of two or more Worts.

RULE.

Multiply the gravity of each wort by its reſpective number of barrels, or gallons. Divide the ſum of the products by the number of gallons, or barrels. The quotient will be the mean gravity required.

Suppoſe	Firſt Wort,	30 barrels,
	at - -	60° gravity.
	Second Wort,	20 barrels,
	at - -	35° gravity.

60°	35°
30 barrels	20 barrels
1800	700
700	

50) 2500 (50° mean gravity required.
2500

. . . .

N. B. When the heat of the worts cannot be conveniently tried at 60° of the thermometer, the following little table will ſhew the number of diviſions to be added for the heat.

Degrees of the Thermometer,	Degrees of the Hydrometer to be added.
60,	0
72,	1
82,	2
91,	3
99,	4

Although the above table may not be found philoſophically true, yet it will not err a quarter of a pound per barrel in any gravity uſed for fermentation. For the uſe of thoſe who are more particular in this reſpect, Mr. Quin has completed a ſcale, which they may apply to their own degrees of heat.